Historical Metallurgy

Conservation of the European mining and metallurgical heritage — Part 1

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In the June 1999 issue of the *CIM Bulletin* an inventory of Mining Museums Across Canada was published. Because museums are an important educational tool and a touristic attraction, it is a pleasure to have professors Octavio Puche Riart and Luis Felipe Mazadiego Martinez respond to our invitation to write about the European mining and metallurgical museums. This is the first of two parts.

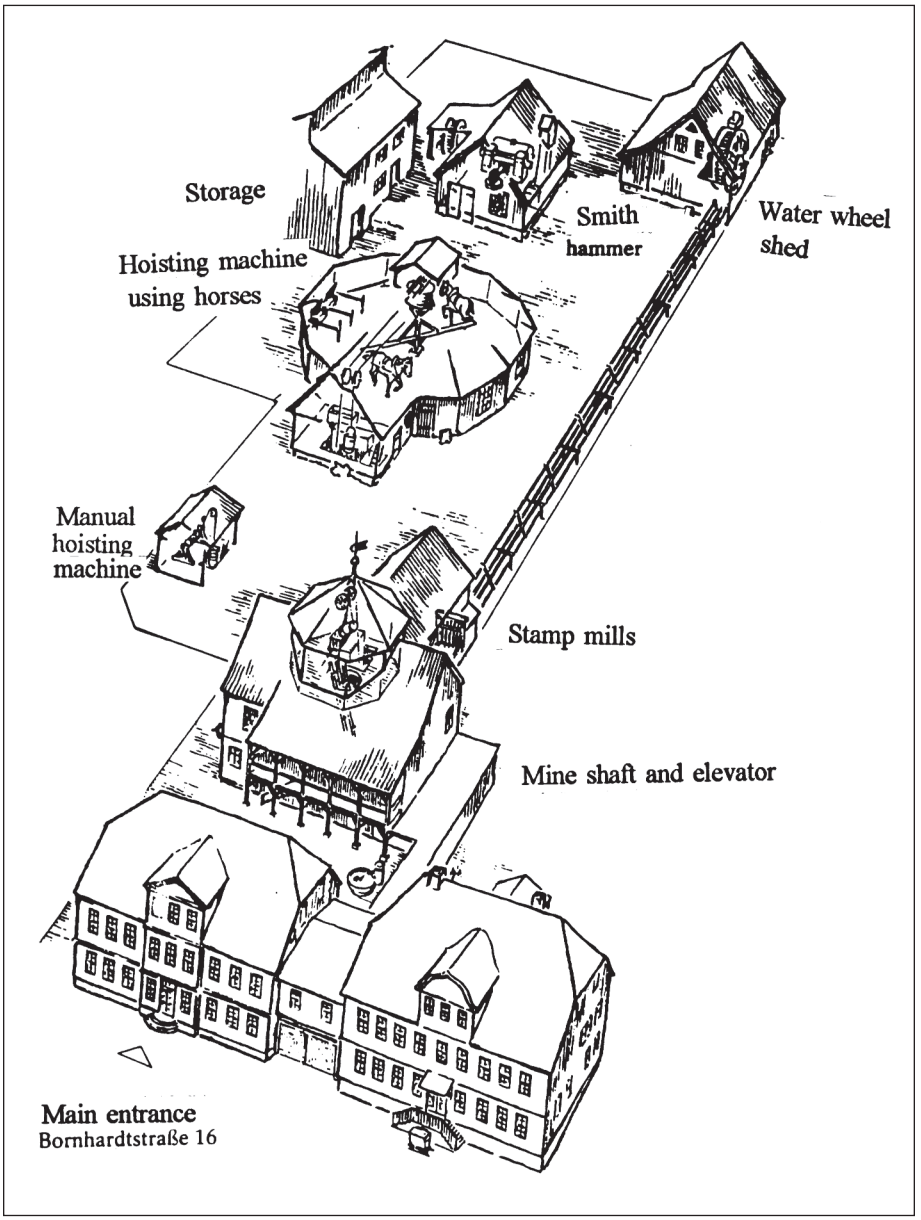
Introduction

Some five hundred ancient mines in Europe have been turned into historical mining museums, protected natural areas, recreational parks, etc. Historically, one of the fundamental pillars of the economy, the mining industry leaves us with an important heritage and the cultural roots of the mining communities.

The first instructions for an inventory of machines, plans and documents of historical value appeared in France in 1790. Shortly thereafter the Parisian inventory was created (1791), considered to be the first technical museum of the world.[1] Something similar took place in London a short time afterwards. Spain provided a pioneering example along this line with the Royal Order of March 15, 1850 which established the Industrial Museum, a section of which was to have been dedicated to mining.[2] The project, however, remained only on paper, due to an accumulating state budget deficit.

In the mid-nineteenth century, the Spanish mining industry experienced a boom that reached its peak toward the end of the nineteenth and the beginning of the twentieth centuries. This involved the use of innumerable techniques, many of them dating from the Roman period, which resulted in the discovery of valuable archaeological material. In 1845, Joaquín Ezquerra del Bayo proposed the conservation of various ancient furnaces that had surfaced in certain slag heaps in Campo de Cartagena and, in 1858, *Revista Minera* (*Mining Magazine*) published the discovery of an ancient foundry in the province of Huelva that had been considered for conservation as a historical monument by the director of the Tharsis mines. To our knowledge, this was the context in which the first Archaeological Mining Museum, the work of Federico Botella y Hornos, chief engineer of the Murcia mining district, was established. According to an anonymous article published in *Mining Magazine* (1862): "An archaeological museum holding all of the objects from excavations and ancient lands is being established in Cartagena."[3] According to Felipe Naranjo (1865), there was a

Fig. 1. Oberzharz national museum in Clausthal-Zellerfeld.



museum of Roman antiquities uncovered in the mines[4] in the same region as that of the San Juan Bautista mine belonging to the "El Fraile" Society. Likewise, in 1864, Ramón Rúa de Figueroa[5] pointed out that "It is noteworthy that an Archaeological Mining Museum hasn't yet been established in our Mining School [Madrid], when objects gathered in our mining regions exploited since the most remote times, would be worthy of study." Here the author does not put forth an original idea but rather iterates one expressed in Fournet's work.[6]

It was the mining engineer and great archaeologist, Casiano de Prado, who, in 1862, first discovered the Paleolithic period in Spain and who initiated the first archaeological mine expeditions, such as the visit to Cerro Murriano in 1866. In charge of organizing the Spanish Mining Division of the Paris International Exposition (1867), he asked the heads of the district for not only mineral ores, but also archaeological tools found in mines and caverns. Because of Prado's death, these objects were presented by his colleague Amalio Maestre. This collection, constituting one of the first archaeological exhibits of antiquities derived from mines, was destined for the Madrid School of Mining Engineers.[7]

Similar exhibits followed — prehistoric objects (7th group) were included in the 2nd Division (Mining) of the Vienna International Exposition (1873). Archaeology having thus become a part of the mining division, historical mining tools were added to the exhibit. In the Madrid National Exposition of Mining, Metallurgical Arts, Ceramics, Glassware and Mineral Waters (1883), there was also a large display of archaeological mining materials. The exhibit presented by the Mining School of Madrid[8] included, for example:

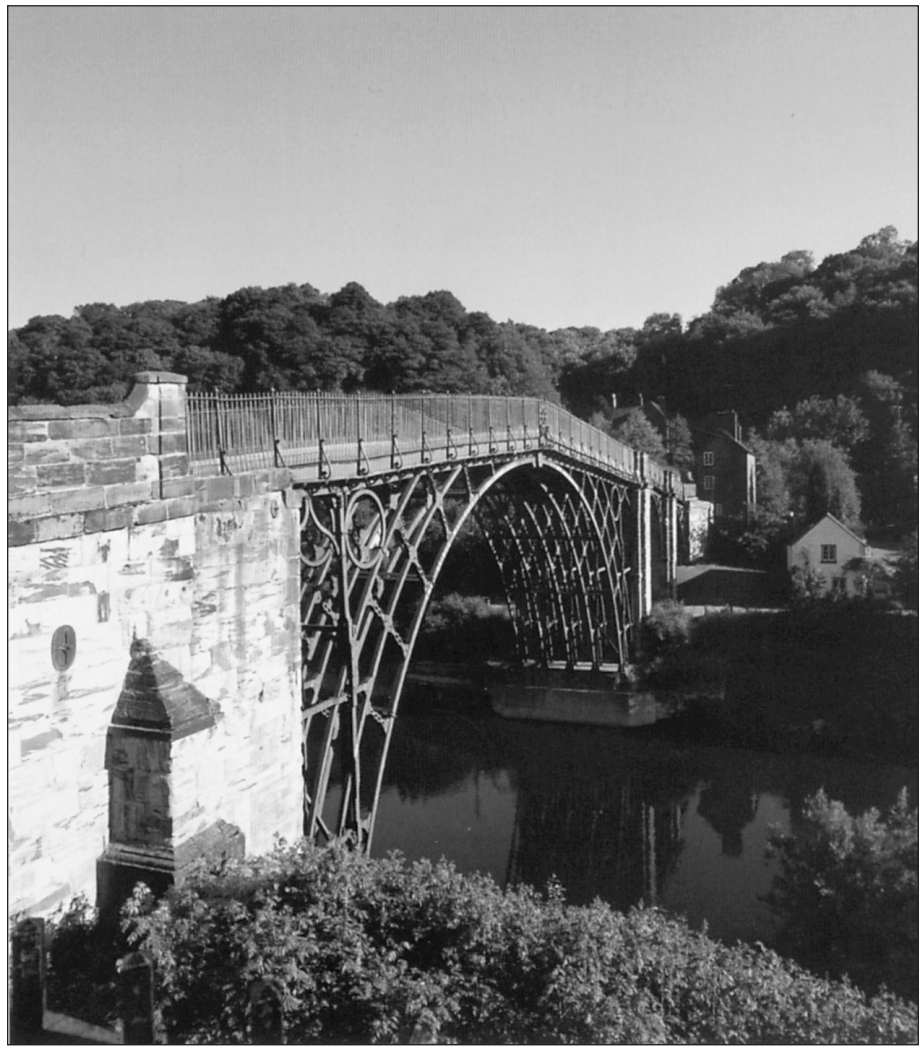
- hand axes from Madrid, Jaén, Horcajo, Olmedilla, etc.;
- spear and arrow tips from Madrid;
- hammers from Sierra Morena, Plasenzuela, Oviedo;
- human skull and jaw from the El Milagro Mine (Onís);
- pine timbering from Río Tinto;
- Roman and Arab mine lamps from Río Tinto, Cartagena, El Pedroso, and Hellín;
- earthenware vases from Hellín and Río Tinto;
- earthenware kylix from El Pedroso, Hellín, and Río Tinto;
- ointment and perfume vases from Río Tinto, Cartagena and Villaricos;
- earthenware from Sierra Almagrera; and
- amphora stopper from Cartagena.

Antique mining objects also were sent from the School to the Universal Expositions of Seville and Barcelona (1929).[9] The first great mining museum is perhaps the Deutsches Bergbau-Museum of Bochum, inaugurated in 1930 and located in the middle of the Ruhr mining valley. Since the museum's beginnings, antique tools such as maces, shovels, picks, lamps, baskets, etc. have been recovered. Machines and facilities such as bombs, drills, steam engines and electricity, timbering, etc. were also recreated, to operating scale. One of the museum's first steps was the installation of the runner of the ancient mine Germania de Dormund in the 1970s.[10] In 1969, the Historical Archives Center was set up in the museum to preserve the archives of German mining companies. The museum currently receives some 400 000 visitors per year. That same year, following the shutdown of the Oberzharz mining industry in Clausthal-Zellerfeld, a National Museum (Fig. 1) was founded in its place, providing a look at the lives and work of the miners. As can be seen, the tendency in the nineteenth and early twentieth centuries was to conserve small tools as well as some machines in museums generally located in urban zones and away from mining valleys, although something of the "in situ" has also been conserved.

The Birth of Industrial Archaeology

In 1906, at the initiative of engineer M. Miller, the Deutsches Museum von Meisterwerken der Naturwissenschaft und Technik was established in München. Today, the Museum occupies 55 000 m^2 of permanent exhibit space and a part of the basement and ground floor dedicated to the mining industry. The Research Institute of the History of Technology and the Sciences is also located within the museum.

Fig. 2. Ironbridge Gorge, Telford, Great Britain.



However, perhaps the first recovery of a mining-metallurgical technical monument is that of Ekilstuna, the ancient Swedish ironworks Radermacher converted into a museum. Spain followed suit in 1952, when Patricio Echevarría and his wife, Teresa Aguirre, organized the reconstruction of la Mirandaola Ironworks (15th century), in Legazpi, Guipúzcoa. But industrial archaeology cannot be considered institutionalized until 1959, when The National Survey of Industrial Monuments, an industrial monument safeguarding division, was created within the framework of the British Archaeology Council. As explained by J.M. Santacreu (1992), the process was long: "The baron of Verneilh, in France, and Isaac Fletcher, in Great Britain, used the term *archaeology* for the first time within the context of the Industrial Revolution, and during the decade of the 1950s, Donald Dudley, Renee Evnard and Michel Rix had already established the term *Industrial Archaeology*."[11] Yet, for some authors, the birth of industrial archaeology took place after the 1962 destruction of the Euston Station in London, when British historians and scientists declared it a monument. The new discipline was taken over by August Buchanan at the University of Bath who used the term "concerns the research, registration, preservation of the industrial remains of the past."[12] The first conservationist mining societies began to operate during the social movement of the sixties.[13]

In 1959, the first coke furnaces — invented by Abraham Davy in 1709 — were discovered in the Coalbrookdale foundry. A short time later, in 1968, the Iron Bridge Valley Museum Foundation was created to restore the local industrial elements. This work began in 1972 with the restoration of the Iron Bridge (Fig. 2), the most ancient of bridges of its class, and in 1979 the Museum of Iron was established to restore the industrial edifices. The museum also houses the Industrial Archaeology Institute, of the University of Birmingham.

One of the first underground mines opened to the public in 1932: the Plaster Cave of Hinterbrüll (1932), located in Mödling, near Vienna. Extractive activity was carried out between 1848 and 1912, but mining was halted by a powerful water current that flooded the mine. After corridors were recovered and electric lighting was set up, boat tours were put in service.[14]

The 1st Congress of Industrial Archaeology was held in 1968 in the Iron Bridge valley. In this period numerous works about this subject began to appear in print (Table 1). The scientific framework of this cultural movement was built via the various congresses, societies and committees organized for that purpose. In 1973, the Iron Bridge Museum was the site of The International Conference for the Conservation of the Industrial Monuments, during which discussions were held about the conceptual definitions of national heritage, archive collections, inventory, recovery, conservation and social aspects. The next of these congresses was held in the Bochum Mining Museum in 1975, where the question of the necessity to organize the The International Committee for the Conservation of Industrial Heritage was raised. The committee's statutes were approved in the subsequent congress held in Grangarde, Sweden, in 1978. Since then, these meetings were held every three years: Lyon and Grenoble (1981); Lowell, USA (1984); Vienna (1987); Brussels (1990); Madrid (1992); Quebec and Montreal, Canada (1994); and Athens and Tsalonica, Greece (1997).

As can be seen, this is an essentially European movement. It should not, therefore, appear strange that the Parliament Assembly of the Council of Europe would have a hand in the matter in 1975, adopting a Recommendation Relevant to Industrial Archaeology. Years later, the Assembly developed a series of workshops: the first was in Lyon-Vaulx in Velin (1985), followed by those of Madrid (1986), Bochum (1987) and London-Durham (1989). In the Bochum workshop, the question of the preservation of national mining heritage was brought up: Technical Mine Monuments as Cultural Heritage.

TABLE 1. Publications devoted to industrial archaeology

Year	Author	Title
1963	Hudson, K.	*Industrial archaeology. An introduction*
1966	Panell, J.P.M.	*The techniques of industrial archaeology*
1967	Rix, M.	*Industrial Archaelogy*
1968	Buchanan, R.A.	*The theory and practice of industrial archaeology*
1969	Gale, W.K.W.	*Industrial archaeology*
1971	Cossom, N. and Hudson, K.	*Industrial archaeologists. Guide*
1972	Raistrick, A.	*Industrial archaeology*
1972	Klingender, F.	*Arte i rivoluzioni industriale*
1972	Buchanan, R.A.	*Industrial archaeology in Britain*
1975	Hudson, K.	*Exploring our industrial past*
1976	Sande, T.N.	*Industrial archaeology. A new look at the American heritage*
1977	Burton, A.	*Industrial archaelogical sites of Britain*
1978	Negri, A.	*L'Archaelogie industriale*
1979	Butt, J. and Donnachie, I.	*Industrial archaeology in the British Isles*
1980	Daumas, M.	*L'Archéologie industrialle en France*

TABLE 2. Mining museums in the United Kingdom

Museum	Location
Big Pit Mining Museum	Blaenafont
Black Country Museum Trust Ltd.	Egbaston
Camborne School of Mines-Geological Museum	Treveenson
CEFN Coed Colliery Museum	Crynat
Clearwell Caves & Ancient Iron Mines Museum	Clinderford
Chatterley Whitfield Mining Museum	Stoke on Trent
Chawarel Hen-Slate Caverns	Llanfair
Ecton Mine Education Center	Ecton
Grevor Tin Mine	Penden
Gloddfa Ganol Slate Mine	Blaenau Ffestinoig
Great Orme Exploration Society	Llandudmo
Iron Bridge George Museum Trust	Sandal
Llechwedd Slate Caverns	Blaenau Ffestinoig
Mid Wales Mining Museum	Ponterwyd
Minera Lead Mines	Chester
Morwellham Quay	Travistock
Mwyngloddiau Gold Mines	Lampeter
National Stone Center	Wirksworth
The Poldark Mine & Heritage Complex	Wendron
Weaver Hall Salt Museum	Nortwich
South Wales Miners Museum	Cynonville
Rhonda Heritage Park	Trehafod
Scottish Mining Museum	Newtongrange
Sygun Cooper Mine	Beddgelert
Tom Leonard Mining Museum	Easington
Underground Quarry Museum	Corsham
Museum of Scottish Lead Mines	Wanlockhead
Welsh Gold	Dolgellau
Welsh Slate Museum	Llanberis
Saldford Mining Museum	Saldford
Big Pit	Blaenafont
Yorkshire Mining Museum Trust Ltd.	Overton/Wakefield

Conservation of the National Mining Heritage

Great Britain

In 1960, the shutdowns of mining companies began, and the immediately ensuing birth of a series of local conservationist societies. In 1979, the Independent Charitage Trust created the Chatterley Mining Museum. The same year, the National Association of Mining History Organizations (NAMHO) was founded upon the inititiative of these societies as well as companies and mining consultancy firms, the Mining Institute and trade magazines. The NAMHO currently encompasses more than 20 mining museums (15 specializing in metals, three in coal, two in stone) and boasts some 2000 members, of whom nearly one half belongs to three societies: the Peak District Mines Historical Society (400 members), the Northern Mine Research Society (300 members) and the Shropshire Caving & Mining Club (100 members).

TABLE 3. Museum visits per year

Museum	Year	Number of visitors annually
Saldford Mining Museum	1980	30 000
CEFN Coed	1980	20 000
Big Pit (Blaenafont)	1983	100 000
Wakefield	1989	100 00

These museums have been established by volunteers and personnel on contract. NAMHO also established codes of practice such as "Code of practice for mineral collecting at disused mines," "Code of practice for mine exploration" and "Code of practice for removal of artefacts." The Society has also set up a data archival system and standards for the editing of reports, as well as insurance for its members. As Eusebi Casanelles pointed out (1993), "In England, the conservation of industrial heritage has become a national fact, and there is no region that fails to advertise these places in its tourist brochures."[15] This seems logical, given that they're pioneers in these areas (Figs. 3 and 4). A collection of British museums is given in Table 2.

The Iron Bridge region currently receives some 300 000 visitors per year and a turnover of US$67.5 million per year[16] (Table 3). The disappearance of the local ceramics, porcelain, and metallurgical industries provoked a re-industrializing project from London which, in effect, created a new city, Telford, which currently has some 160 000 inhabitants. The government took upon itself the restoration costs, and provided financial support for the initial stages of the museum. The second most important museum of the area is perhaps that of the Beamish mining region.

In terms of professional training, we should emphasize courses for the conservation of material, buildings and recovered mines: the Conservation of Industrial Collections Forum (1969), organized by the London Science Museum, and the Mining and Industrial Heritage Management master's course established by The Camborne School of Mines for the 1995-1996 year. One must take into consideration not only the restoration of the various elements of the mining heritage, but its inventory as well. According to J.M. Santacreu (1992), "… [these inventories] were in the hands of the individual societies until 1979. Today's individual English inventories have been compiled by the Royal Commission on the Historical Monuments of England, but the recovered objects are in very different states of restoration, due to the fact that there were no unified criteria at the time of these inventories".[11]

France

In 1955, the celebration of the international colloquium *Iron Through the Ages* took place in Nancy, in the heart of Lorraine. One of its recommendations was the creation of a research centre for the history of iron metallurgy. This institution, founded in 1957, in turn led to the foundation of the Nancy Iron Museum, inaugurated at the end of 1966. The latter is considered to be the most complete museum of iron and steel in the world .[17] Likewise, when the Temoin d'Alès Mine, a training centre for the miners of Cévennes opened by pit coal societies in 1945, faced a possible shutdown, it was transformed into a historical mining

Fig. 3. Geevor tin mine, Pendeen-Cornwall, Great Britain.

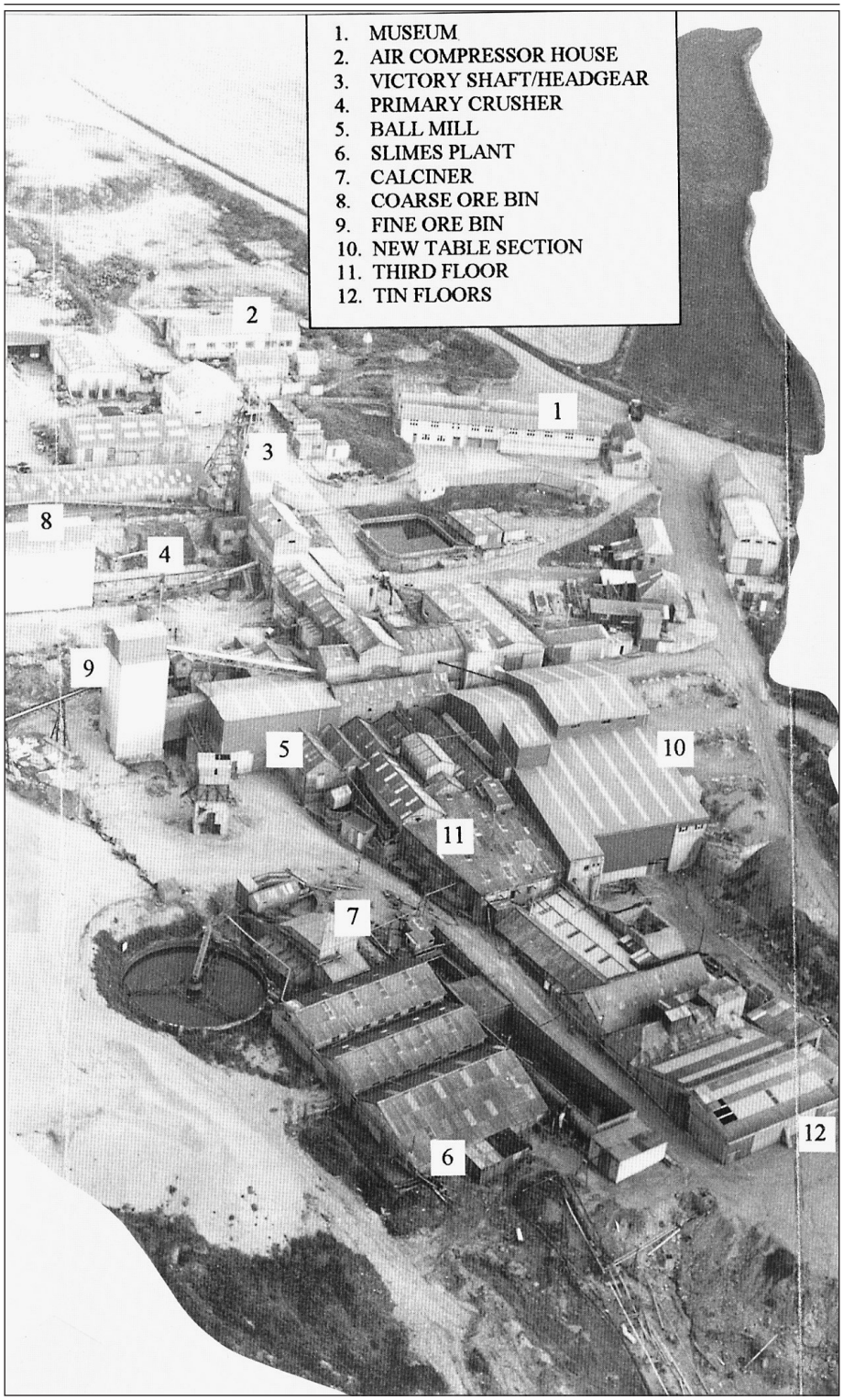
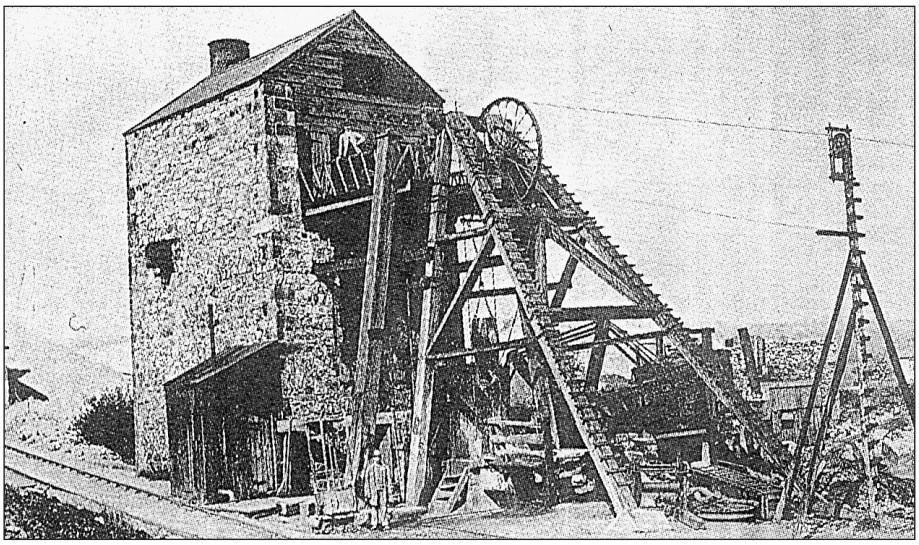


Fig. 4. Minera lead mines, Wrexham, Great Britain.



centre in 1960, and opened to the public in 1985.

France's main contribution, however, is the ecomuseum, i.e. a region with importance according to an industrial period and where nature and industries such as mining are related and integrated. A colloquium entitled *Industrial Heritage and Contemporary Society — Locations - Monuments - Museums* was held in 1976 in the ancient mining and glassworks region of Le Creusot, Bourgogne. Given the economic crisis caused by the increase in petroleum prices, the socioeconomic dimension of the conservation of national heritage often comes into play. Industrial remains are effectively fused to the land and the historical and cultural values of the mining communities. An immediate reaction was the creation of the Ecomuseum of Le Creusot-Monceau-les-Mines, and others such as the Ecomuseum of Fourmies-Trelon, which offers a series of activities.

In the 1980s, a dozen mining museums were inaugurated, including the ecomuseums and museums of stone or quarries. According to Watelet and Schawartzman (1991), "Currently about one subterranean tourism center is inaugurated in France per half-year." [18] Today, this tendency has increased considerably. Some French mining metallurgical museums are shown in Table 4.

The closing of the French pit coal industry took place in the 1980s. This led to a progressive deterioration of this national heritage, which induced the creation of local protectionist associations as well as actions on the part of companies themselves. Many of these projects were supported by the Ministry of Culture. There were also other isolated projects such as the Puits (shafts) de Cagnac in Le Tarn, or the Puits Glenoms a la Machine in Nievre. Most importantly of all, two great museums were created: Lewarde and Couriot.[19]

The Historical Mining Center of Lewarde, a short distance from Douai, was inaugurated in 1982 with support from local and regional collectives as well as the Ministry of Culture and the private enterprise Houillières du Nord-Pas-de-Calais. The center consists of a subterranean tour, 450 m in length, reconstructed on the Fosse Delhoye — mines characteristic of the thirties, accessible by means of a simulated descent in a cage. All of the aspects of a mine and a miner's life are evoked within the restored surface and interior installations. This center houses 10 000 objects, 5000 graphic works, 300 films and 2 km of mining archives, and receives 150 000 visitors per year.

Couriot, the other great coal mining museum, was inaugurated in 1991 (Fig. 5). This shaft was exploited between 1913 and 1973, providing jobs to 1500 miners during its more prosperous years. The miners extracted 3000 metric tons of ore per day. Its re-opening as a mining and industrial museum involved the restoration of 350 m of corridors. Visits to the interior, overseen by highly automated monitoring systems, include ancient sites complete with pickhammers and beasts of burden. Another great museum of a similar format is currently being established in Petite Roselle. The ancient subterranean shale mines of Noyant-la-Gravoyère, with a descent via funicular to a depth of 126 m, have been integrated into a large theme park (natural areas, children's train, fishing, water sports, mini-golf, etc.) A mere two months after its opening, it was already receiving 600 to 800 visitors daily.

TABLE 4. Mining and metallurgical museums in France.

Museum	Location
Anciennes Mines d'Ór du Limousin	Pontgibaud
Centre Historique Minier	Lewarde
Couriot. Musée de la Mine	Saint Etienne
Ecomusée de Le Creusot-Monceau-Les Mines	Le Creusot
L'Argentièrie de Brandis	Alpe d'Huez
Maison de l'Antimonie	Masiac
Mine Blue	Noyant-la-Gravoyère
Mines d'Argent du Fournel	Argentière-la-Bessée
Mines d'Argent des Rois Francs	Melle
Mines du Briançonais	Villard Saint Pancrace
Mines de Cuivre et d'Argent de la Haute Vallée de la Moselle	Le Trillot
Mines du Laurier	Plancher-les-Mines
Musée du Cap de Garone. Musée de Fer	Nancy
Musée de la Mine	Blanzy et La Machine
Musée de la Mine	Petit Roselle
Musée des Mines	Carnaux
Musée des Mines de Pierre	Vincennes
Musée Regional de Geologie	Decazaville
Volcan de Lemptegy	Saint Ours

In 1982, a National Program for Archaeological Mining Research (Program H-03 of the Conseil Supérieur de la Recherche Archéologique) was implemented under the direction of the Ministry of Culture and the CNRS. Its purpose was to coordinate the work of universities, associations and independent researchers.[20] Likewise, the Industrial Heritage Decree was created within the framework of a 1964 Monument Inventory Plan designed by the National Heritage Department of the Ministry of Culture.

Germany

After the Deutsches Museum of Münich and the Deutsches Bergbau-Museum of Bochum, other museums began appearing, such as the Musée de Mine Houillère (Saarland Mine-Museum) of Bexbach (1934), which safeguards coal mining mementos in the Saar valley. Its main attraction is a model of a subterranean mine where the visitor is familiarized with the work of the miner. In 1974, The Museum of Sulphides of Ramsbeck, formerly a mine that operated between 1559 and 1930, was inaugurated; it receives some 100 000 visitors annually. Another museum mine of the period is the Historisches Kupferbergwerk of Fisbach, opened to the public in 1979, receiving some 80 000 visitors per year.[21]

In a book entitled "Schau und Besucher Bergwerke," Heinz Walter Wild

reviewed 74 mining museums in Germany, 14 in Austria and 4 in Switzerland.[22] In 1985, the National Tourist Office of Germany published a guide of 130 museums, including various mining museums.[23] Germany currently has the greatest number of mining museums and museum mines (Table 5).

Recently, the Vöcklingen Iron and Steelworks, a veritable cathedral of iron and steel in operation from 1873 through 1986, has been declared a World Heritage Site. In 1993, the 1st Symposium on Cultural Heritage in Geosciences, Mining and Metallurgy, dedicated to library, archival and museum themes, was held in Freiberg. Germany has been a pioneer in the salvaging of industrial archives: in

TABLE 5. Mining museums in Germany

Museum	Location	Museum	Location
Bergakademie Freiberg Grube Alte Elisabeth	Freiberg	Historisches Silberbergwerk Alte Hoffnung Erbstollen	Schönborn-Dreiwerden
Bergbau und Industrien Osterbayern	Kümmersbruck	Historisches Silberbergwerk Hella-Glückstollen	Neubulach
Bergbaumuseum Oelsenitz	Oelsenitz-Erzgebirge	Historisches Silberbergwerk Grube Samson und Heimatmuseum	St. Andreasberg
Bergbaumuseum des Kreises Altenkirchen	Herdorf-Sassenroth	Hüttenstollen	Salzmmendorf
Bergbaumuseum Peissemberg	Peissemberg	Kalkbergwerk	Wolfstein
Bergbaumuseum Ramsbeck	Beswig-Ramsbeck	Kupferbergwerk Bertsch	Bad-Widungen-Bergfreiheit
Bergbaumuseum Röhrigschacht	Wettelrode	Landermuseum Volk und Wirtchaft	Düsseldorf
Bergbau und Stad Museum Weilburg	Weilburg	Landerbergmuseum	Sulzburg
Bergisches Museum für Bergbau	Berggish-Gladbach	Lehrbergwerk Grube Rater Bär	St. Andreasberg
Bergwerkmuseum Hilchenbach-Müsen	Hilchenbach-Müsen	Lehr und Schaubergwerk Herkules Frisch Glück	Waschleithe
Besucherbergwerk Finstergrund	Wieden-Utzenfeld	Mülenberg Stollen	Bleihalf
Besucherbergwerk Eisenerzgrube St. Anna-Stollen	Northweiler	Museum für Naturkunde	Dortmund
Besucherbergwerk Grube Fortuna Oberbeil	Wetzlar	Neubeschert Glück Stollen	Altenberg
Besucherbergwerk Grube Anna-Elisabeth Schiesheim	Schriesheim	Niedersächs Bergbaumuseum	Langelscheim
Besucherbergwerk Grube Cristina	Willingen	Oberharzer Bergwerkmuseum	Clausthal-Zellerfeld
Besucherbergwerk Grube Gustav	Meissner-Abterode	Rammelsberger Bergbaumuseum	Goslar
Besucherbergwerk Grube Windeweide	Gebharshain	Ruhrlandmuseum	Essen
Besucherbergwerk Kilianstollen	Masberg	Saarländisches Bergbaumuseum	Bexbach
Besucherbergwerk Kleinenbremen	Porta Westfalia	Salzbergwerk Berchtesgaden mit Salzmuseum	Berchtesgaden
Besucherbergwerk Reindl-Stollen	Eisenberg	Sanierungsbetries 371	Aue
Besucherbergwerk Schmittenstollen	Bad Münster	Schauanlange Silberstollen Geising	Geising
Besucherbergwerk Teufelsgrund	Münstertral	Schaubergwerk Büchenberg	Elbingerode
Besucherbergwerk Tiefer Stollen	Aalen	Schaubergwerk Finstertal	Asbach
Besucherbergwerk Harrenberg	Bundenbach	Schaubergwerk Glöckl	Erzgebirge
Edelsteinminen im Steinkaulenberg Idar-Ostein	Idar-Ostein	Schaubergwerk Wocklund	Balve
Emilianusstollen	Saarlius	Schieferschaubergwerk Raumland	Bad Berleburg
Erlebnisbergwerk Merkers	Merkers	Siegenlandmuseum	Siegen
Erzbergwerk Bodenmais	Bodenmais	Silberreisenbergwerk Gleissinger Fels	Bayreuth
Frisglück Besucherbergwerk	Neuenburg	Stadt und Bergbaumuseum	Freiberg
Deutsches Bergbau-Museum	Bochum	Stadisches Museum für Bergbau und Industrie	Brand-Erbisdorf
Deutsches Museum München	München	Steinkohlbesucherbergwerk Rabenstein Stollen	Clausthal-Zellerfeld
Deutschesmontantechnologie für Robstoff Energie	Essen	Steinsalzbergwerk Kochendorf	Heilbronn
Graphitebergwerk Kropfmühl	Hauzenberg	Techniches Landesmuseum	Schwerin
Grube Christiane	Diemelsee	Tiefer Molchner Stollen	Pobershau
Grube Markus Röling	Frohnau	Traditionsstäte Erzbergbau	Aue
Grube Schauinsland	Freiburg	Unverhoffter Segen Gotes Westfälischen mit Radstube	Oberschöna
Haus der Heimat	Freital	Weisse Grube	Kirchheimboladen
Heimat und Bergbaumuseum mit Schautollenanlage	Weiburg	Westfälischen Industriesmuseum	Dormund
Heimat und Bergbaumuseum Burg Tannenberg	Nanterschusen	Zinnbergbaumuseum	Altenberg
Heimatmuseum des Zeitz-Weissenfelser Braunkohlenreviers	Teuchen	Zinnergrube Sauberg	Ehrenfriedsdorf
Historisches Bergwerksanlage 19-Lachter-Stollen	Widemann	Zinner Gmbh Altenberg	Altenberg

Fig. 5. Couriot. Musée de la mine, Saint Etienne, France.

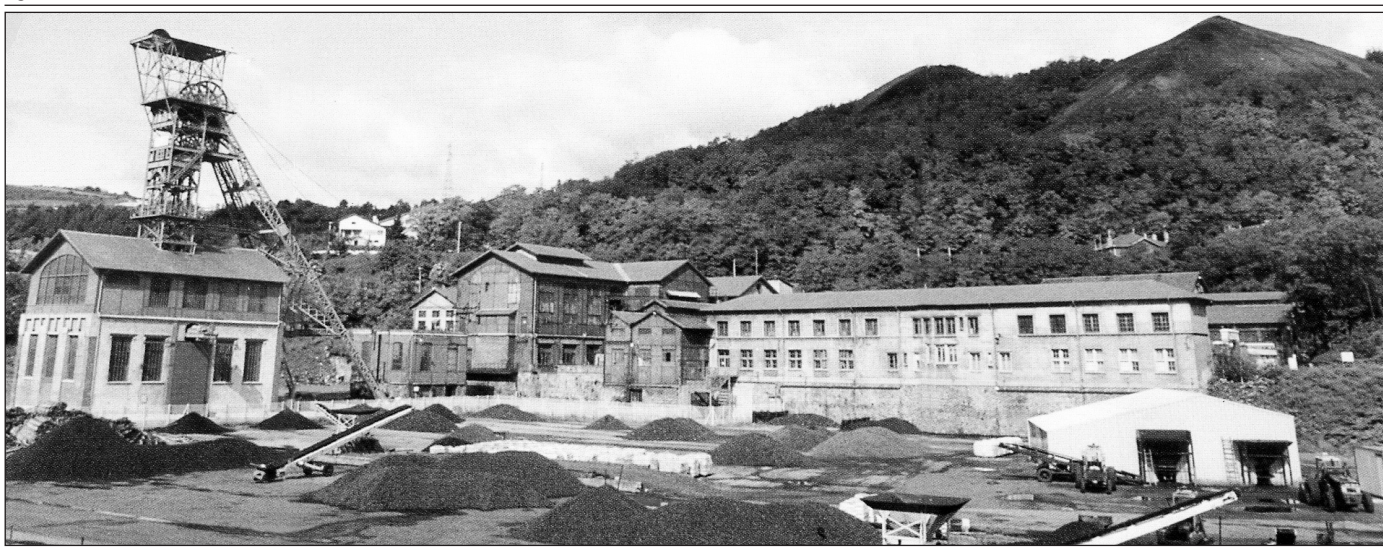


Fig. 6. Silver mine in Schwaz, Austria.

1903, the Krupp company had already organized its archives in Essen.

Austria

In 1976, the Federal Bureau for the Protection of Monuments created a Department of Industrial Monuments. The first relevant efforts were undertaken by the Regional Association of Iron Ore of Styria from 1983 onward.[24] In 1985, the national mining heritage was discussed at the Conference on the Mining Industry of Pitten in Lower Austria; the same year, a Department of Industrial Archaeology was created in the University of Vienna. The 1987 meeting of the International Committee for the Conservation of Industrial Heritage, whose main purpose is to dedicate industrial monuments to the tourism industry, encouraged this to some extent. Also, in that same year, the Day of the Miner was celebrated in the city of Leoben, the location of the School of Mines. In 1991, the Erlebnisbergwerk in Österreich (Adventures in the Mines of Austria) Association, which links many of Austria's museum mines, was founded in Eisenerz, Styria.[25]

The main museum mines are the sulphide-silver mines of Schwaz, exploited between 1490 and 1957 (Fig. 6), and the iron mines of Eisenerz. The latter, in operation for 2000 years (until 1988), were turned into museums a little less than a decade ago, as were the former, when the mining industry's crisis provided an alternative for tourism. Likewise, as a result of the government's decision in 1992 to close the metallurgical industry in the Vordenberg valley, the valley became a tourist centre. Austrian museums and mines are shown in Table 6.

TABLE 6. Austrian mining museums

Museum	Location
Bergbaumuseum Klagenfurt	Klagenfurt
Historisches Silbergruben	Oberzeiring
Muelbach	Muelbach
Radwerk IV Blast Fournace	Vordenberg
Salzbergwerk Altausse	Altausse
Salzbergwerk Bad Ischl	Bad Ischl
Salzbergwerk Hallein	Dürnberg
Salzberger Hallstatt	Hallstatt
Schaubergwerk Erbstollen Kupferplatte	Jochberg
Schaubergwerk Schawarzaleo	Leogang
Silberwerk Schwaz	Schwaz
Steinölschaubergwerk	Pertisau
Terra Mystica	Bad Bleiger
Schaubergwerk Hüttenberg	Hüttenberg-Kärntern

Among the ancient mines, Hallstatt holds an exalted position. Its activity dates back to 2000 BC, the period of the Bronze Age, continuing until the beginnings of the Iron Age. In 1846, Georg Ramsauer, the director of the mine, discovered and analyzed a miners' necropolis from the first millenium AD, with 900 persons who had been buried with all of their belongings (clothing, weapons, domestic tools, etc.) This facilitated the study of many aspects of Celtic life. The development of various exhibits on this subject proves beyond a doubt the importance of this mine: exhibits such as Die Hallstatt Kultur. Exposition International (1980) or Das Österreiches Bergbau (1987). The mines have been prepared for visits, with large wooden toboggans that link the various levels of the mine.[26]

Benelux

In 1971, the open-air Museum of Rural Life in Wallonia was created in Belgium and, in 1978, the Museum of Iron and Ancient Metallurgy of Saint Hubert (Luxembourg), together with the Fourneau Saint-Michel (18th century), were established as part of the former. This Museum of Iron receives some 30 000 visitors per year. A branch of the Museum of Wallonian Rural Life has also been opened in Liége, called the House of Metallurgy and Industry (Museum of Iron and Coal). A description of the current steel production accompanies the charcoal furnace of the Wallonian Ironworks (17th century).

In 1974, the authorities of the Royal Circle of the History and Archaeology of Ath implemented the idea of creating a Museum of Stone in Maffle. The local quarries had ceased their activities in 1964 and were keen on preserving their memory. But this museum, founded in a castle, would not be inaugurated until 1989, thanks to the work of J.P. Ducastelle, director of the Stone's Museum of Maffle.

TABLE 7. Mining museums in Belgium

Museum	Location
Diamant Museum	Grobbendonk
Ecomuseum and Archives of the Boom Brickworks	Boom
Geologisch Museum	Bochlot
Mijnmuseum	Beringen
Musée d'Arenberg-Musée du Porphyre	Rebeq-Rognon
Musée du Coticule	Vielsam-Salmchateau
Musée de la Mine	Houdeng-Aimeres
Musée de la Mine et Musée du Clou	Fontaine-L'Eveque
Musée du Fer et du Charbon	Liége
Musée du Fer et de Metallurgie Ancienne	Saint Hubert
Musée National du Marbre	Rance
Musée de la Pierre	Maffle
Musée de la Pierre	Muno
Musée de la Pierre et du Marbre	Basécles
Musée de la Pierre	Soignes
Musée du Silex	Eben-Emael
Musée Regional de la Pierre	Sprinmont
Carriéres souterraines du Géromont	Camblain-au-Pont
Ardoisiéres	Bertrix
Musée de la Mine Les Wagneaux	Wasmes

Belgium has numerous museums of stone; the most ancient of which is probably the National Museum of Marble in Rance, exhibiting various aspects of the marble industry so typical to this region.[27] This museum was established by the Society of Regional History of the Beaumont-Chimay and Sirvy-Rance districts, with the collaboration of the B.B.L. Bank.

Many coal mines have been restored. In 1979, the Mining Museum of the Bois du Luc was opened in these mines, abandoned in 1973; in 1980, the shutdown of the Argentau-Trimbleur mine in Blégny-Trimbleur caused its rapid conversion into a tourist complex. The most important current project is Le Gran Hornu, promoted by the Wallonian Society of Industrial Archaeology and the government of the Hainaut province. This reconstruction of a mining town and part of its abandoned industrial remains succeeded the shutdown of coal production in the Hornu-Wasmes mine (1954) in the pit coal valley of Borinage. The Wagneaux Mine Museum currently enjoys 200 m of corridors of the Hornu-Wasmes, opened in 1932 to fulfill the practical needs of the professional training for miners. The main mining museums of Belgium are given in Table 7.

In The Netherlands, the Mijnmuseum in Kerkrade deals with the life and work of miners and receives some 300 000 visitors per year.[12] The autonomous constituency of the heritage inventories should be emphasized. In the Wallonian territories, the Society Patrimoine Industrial Wallonie-Bruxelles is responsible, while in the Flemish regions the responsibility is fulfilled by a Cédule du Patrimoine Industrielle, belonging to the

TABLE 8. Mining museums in Scandinavia

Museum	Location
Goldprospector Museum	Tankavaara (Finland)
Outokumpu Mining Museum and Old Outokumpu Mine	Pitkälahti Harbor (Finland)
Tytyrin Kalkkikaivomuseum	Lohja (Finland)
Modums Blaafarveverk	Amont (Norway)
Museene På Løkken	Løkken (Norway)
Naes Jenverkmuseum	Arendal (Norway)
Norsk Teknisk Museum	Oslo (Norway)
Norwegisches Bergwerkmuseum Kronsberg	Kronsberg (Norway)
Oscar Gold Mining	Bremnes (Norway)
Rørosmuseet	Røros (Norway)
Stesdtal Mineral Park	Hornes (Norway)
Sulitjelma Gruvemuseum	Sulitjelma (Norway)
Långbans Gruby	Filstad (Sweden)
Kullberg Quarries	Kullberg (Sweden)

Flemish government's Department of Monuments and Historical Places.

Scandinavia

Eusebi Casanelles (1993) pointed out that "In the Baltic countries, the territory museums have been widely accepted, due partly to the population's ecological sensitivity. This has led to the conservation of not only the environment but also the rural heritage, a good part of which is related to the technical world (windmills, exploitation of mines and forests that preserve all the pertinent infrastructures such as the workers' houses, etc.)."[15]

In the 1970s, in Lappland, Finland, a certain form of tourism based on the restoration of the gold prospecting techniques (using the trough) was being organized in Tankavaara. In 1977 to 1978, the wooden house that had originally served as the headquarters of the Lapin Kulta in Härkäselkä was dismantled and rebuilt, piece by piece, in Tankavaara, as the Museum of Minerals and Precious Stones. Likewise, material and equipment related to gold mining, as well as facts relevant to the history of this metal in Finland, were recovered. The project Golden World was launched in 1994, with the intention to exhibit the history of gold of 20 countries. This permanent exposition was inaugurated in the summer of 1995.

The 3rd Congress of the FICCIM, held in 1978 in Grangarde, Sweden, addressed the Statutes of The International Committee for the Conservation of the Industrial Heritage and sought to define the concept of an industrial heritage. In the wake of the interest that this Congress provoked, projects were undertaken such as the recovery of the mining town of Langban in the Värmland region, initiated in 1983. These iron and dolomite mines, dating from the early 18th century, ceased producing ore in 1958, and stopped functioning altogether in 1972. Today, they have been converted into an open-air museum.

TABLE 9. Mining museums in Italy

Museum	Location
Antica Minera d'Oro della Guia e Casa Museo Walser	Macuznaga
Museo Geo-Paleontologico dei Colli Euganei. Cava Bomba	Cinto Euganeo
Corte della Miniera	Urbino
Museo del Marmo	Carrara
Museo Minerario de Abadía S. Salvatore	Abadía S. Salvatore
Museo Minerario Regionale della Valle d'Aosta	Champdepraz
Museo Provinciale della Miniere Monteneve-Ridanne	Vipiteno Schneeberg
Museo di Scienza della Terra	Crodo
Museo della Sotoria delle Miniere de Pirita	L'Iglesia
Museo Sotorico Minerario	Massa Maritima
Museo Storico Minerario de Perticara	Santarcangelo
Museo Storico dell'Oro Italiano	Predosa
Miniere degli Escartons	Perosa Argentina

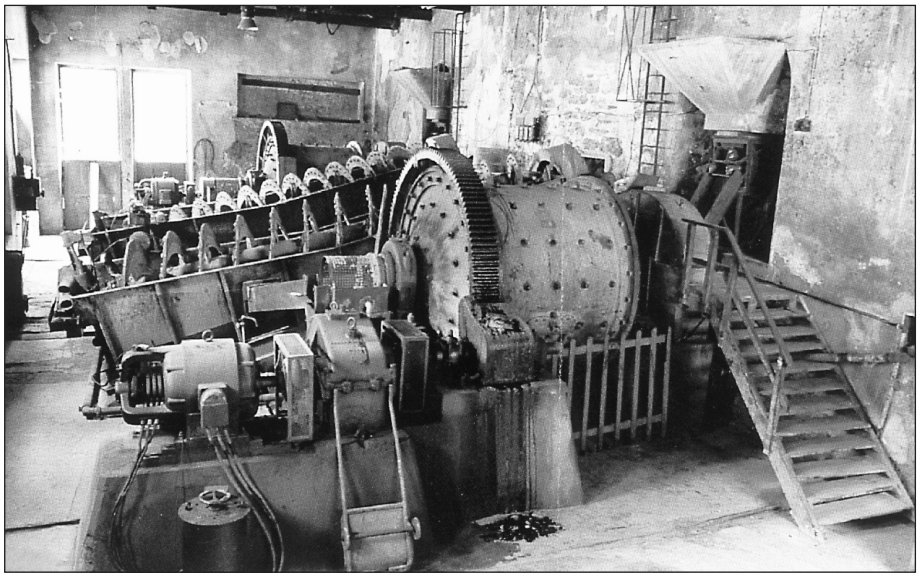
Another important example of the recovery of the metallurgical heritage are the Walloon Ironworks. Around the old iron mines of Dannemora in the north of Uppsala, a series of ironworks were established in the 17th to 18th centuries, such as the Walloon Ironworks in Österbybruk; the Lancashire Ironworks in Karlholms; the Ironworks Museum of Forsmarks; or the iron and steelworks of Vällnora. They have since been restored. In May 1985, the Importance of Ironmaking conference was held in Norberg, Sweden. One of its main themes was the preservation, restoration and reconstruction of ancient ironworks. In Norway, the silver mines of Kronsberg, exploited from the 16th century until the 19th, was converted into the Norwegian Mining Museum in 1987. The restored museum, church and artistic wooden buildings (17th to 19th centuries), together with other museums in an exceptional natural environment, recreate local history. The main mining museums are listed in Table 8.

Italy

In the congress held by the Associazione Nazionale Ingegneri Minerari in 1986 in St. Vicent, chemical engineer, G. Citran, presented the discourse entitled "Miniere-Museo. Sono possibili?" ("Mining Museums: Are there possibilities to create them?"). Since then, this association organized, in 1991, a Congress on National Mining Heritage: the 1st Convegno Valorizzazione dei Siti Minerari Dismessi in Abadía San Salvatore, a town very close to the mercury mines of Monte Amiata. In 1993, the International Congress on Esperienze Europee di Valorizzazione Turistico Culturale del Patrimonio Minerario was held; the 2nd Convegno Valorizzazione dei Siti Minerari Dismessi, was held in Cagliari, Sardinia, in 1994. More than 300 participated in the latter scientific forum.

In 1987, the Museo Storico dell'Oro Italiano (Gold's Museum of Italy) was inaugurated in Predosa. Shortly thereafter, in 1989, the local administration of Abadía-S. Salvatore had given an order to design an urban plan of the region, intending to create a mining park; it is no surprise that this town was elected for the 1st Agreement on National Heritage organized by "National Association of Mining Engeneers of Italy (ANIM). In the early nineties, other projects were undertaken, such as the Metallurgical Museum of the

Fig. 7. Ore dressing equipment at the mining museum in Schneeberg, South Tyrol, Italy.



Aosta Valley and the Museo Storico Minero di Perticara, related to the sulphur mining industry (inaugurated in 1994). Following the congresses of ANIM, many of the new museums or projects, including those of Sardinia, were coordinated (Table 9).

The Italian Minister Ronchey created the Comitato dei Beni Culturali Nazionali per l'Archaeologia Industriale, (Commission of Industrial Archaeology) composed of a multidisciplinary group of 50 persons. This Commission's goal is to study, research and inventory the Italian industrial heritage, and ultimately produce a catalogue (Fig. 7). In Sardinia, Law 29/94 of June 9 was created to protect and define the industrial-archaeological problems of this island endowed with a great mining history. The law foresaw the creation of a Regional Commission for the Safeguarding on the Industrial Archaeological Heritage, with the consultation of the Ministry of Education. The function of the Commission was to evaluate local authorities' previous proposals for the evaluation and use of abandoned mining centres and installations.[28]

Fig. 8. Mine shaft at Rio Tinto Museum, Huelva, Spain.

Spain and Portugal

The initiative to create the Museum of Science and Technology of Catalonia (MNCTC) came from the Catalonia School for Industrial Engineers in 1977.[29] The 1st Conference on the Protection and Reassessment of the National Industrial Heritage was held in Bilbao in 1982 and the second in Barcelona in 1988. Three Catalonian congresses on the subject were also organized. The 1986 National Plan included, among the actions proposed, the construction of the Museum of Mining and the Industry of Asturias. The development of the project in 1992, on the spoil heap of the San Vicente shaft in El Entrego, facilitated the inauguration of the Museum in 1994. More than 80 000 visitors annually come to the Museum.[30] In Portugal, the first such activity was perhaps the 1st National Meeting on Industrial Heritage, held in Coimbra in 1989.

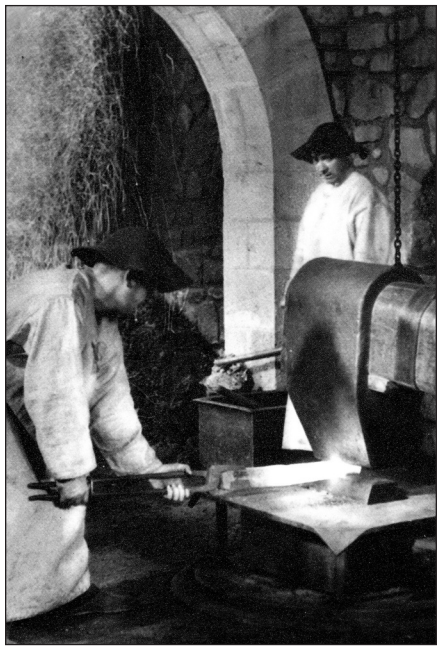
The 1st Iberian Conference on National Industrial Heritage and Public Works was held in Seville in 1990. In 1992, Madrid was the host of the 8th International Congress for the Conservation of the Industrial Heritage. Likewise, the Madrid-based Spanish Association of the National Industrial Heritage and Public Works and the Lisbon-based Portuguese Association of Industrial Archaeology (APAI) were established in the early nineties.

The Río Tinto Museum opened in 1992, upon the initiative of the Foundation bearing the same name. The latter was created after the copper crisis of 1986 to develop the region (Fig. 8). Thanks to the improvements of late 1992 and November 1993, the museum now consists of 15 rooms and covers 1600 m^2. The admission to the museum also includes a ride on the mine railway, a visit to a necropolis and the Corta Atalaya surface mine, etc. Rides through the interior are planned for the opening of the Alfredo shaft. The number of visitors annually is aproximately 35 000.[31]

In 1991, the Arrayanes Project for the recovery of the national industrial-mining heritage of Linares was started; the project is still in the implementation phase. [32] In 1992, the Association of Friends of the Museum "San Blas Ironworks" took the first step to create a mining museum in Sabero. The first subterranean museum mine opened to the public in October 1993 — the Neolithic variscite-turquoise mines of Can Tintorer in Gavá, Barcelona.

Upon the initiative of the MNCTC, the 1st International Symposium on the Catalonian Ironworks was held in Ripoll in 1993. Prior to that, the Association of Friends of the Cades Ironworks had organized several meetings on the Restoration

Fig. 9. Mirándola Ironworks, Legazpi, Spain.



of the Ironworks in the North of Spain[33] (Fig. 9).

In the 9th International Congress on Mining and Metallurgy, held in León in June 1994, various discourses on the conservation of the national mining heritage were presented. This led to the declaration of the necessity for the various administrations to act urgently to protect and assess the important national mining and metallurgical heritage of Spain.[34] Shortly thereafter steps were taken to establish the Spanish Society for the Defense of the National Geological and Mining Heritage, legally put into effect in late 1995. Today, the society boasts more than 250 members. The 1st Scientific Session of the Spanish Society to Defense of Geological and Mining Heritage (SEDPGYM): National Mining and Metallurgical Heritage, was held in Almadén in October of 1996; it was the first national symposium to address this subject and sought its conceptual definition at the final round table discussion. A list of Spanish museums is given in Table 10.[35]

Local or regional initiatives should be mentiond with regard to the inventories of national heritage. A General Inventory Project for Industrial Heritage will be put into effect in Catalonia. The Murcia National Heritage Department has been conducting an inventory of the industrial heritage in that region for the past few years, emphasizing 95 referenced architectural elements of the historic mining industry of the Sierra de la Unión-Cartagena. Let us also highlight the inventory with a photo of mine runners, carried out by G. García et al.,[36] as well as the inventory of the Mining-Metallurgical Heritage of the Map of Murcia, carried out by O. Puche, in 1996, for the first version of the Environmental Map of Spain. Other partial initiatives have also been introduced in Asturias and other communities. The Museum of Mining and Industry of El Entrego holds the archives of the Spanish Pit Coal Society and of Santa Barbara. Likewise, the Museum of Geomining holds archives of the company ADARO. The HUNOSA archives are kept in the Fondón shaft, in Asturias, and the centenary celebrations of the Hullera Vasco Leonesa S.A. Company have been organized by the Vasco Leonesa (Basque-Leonese) Pit Coal Foundation in La Robla.

TABLE 10. Mining museums in Spain

Museum	Location
Roman Quarries	Canteras (Murcia)
Bañolas Copper Foundries	Bañolas (Gerona)
D'Ordeig Ironworks	Ordeig (Barcelona)
Lead Mines	Bellmunt (Tarragona)
Mines and Mountain of Salt	Cardona (Barcelona)
Neolithic Mines of Can Tintorer	Gavá (Barcelona)
Aia Ironworks	Zarauz (Guipúzcoa)
Besullo Ironworks	Cangas de Narcea (Asturias)
Cades Ironworks	Herrerías (Santander)
Cerain Ironworks	Cerain (Guipúzcoa)
Dos Teixos Ironworks	Taramundi (Asturias)
Mirandaola Ironworks	Legazpi (Guipúzcoa)
Mazanovo Ironworks	Santa Eulalia de Oscos (Asturias)
Belmonte Monastery Ironworks	Belmonte (Asturias)
Compludo Ironworks	Compludo (León)
Las Médulas	Caraucedo (León)
Geomining Museum (ITGE)	Madrid
D. Felipe de Borbón Historical Mining Museum	Madrid
Francisco Pablo Holgado Mining Museum	Almadén (Ciudad Real)
MAYASA Museum	Almadén (Ciudad Real)
Mining Museum of Castilla and León	Sabero (León)
Mining Museum of Cataluña	San Corneli/Cercs (Barcelona)
Museum of Mining and Industry	El Entrego (Asturias)
Municipal Museum of Puertollano	Puertollano (Ciudad Real)
Municipal Museum of La Unión	La Unión (Murcia)
National Museum of Science and Technique of Cataluña	Tarrasa (Barcelona)
Museum of Slate	Trones (León)
Río Tinto Museum	Río Tinto (Huelva)
Museum of Ripoll	Ripoll (Gerona)
Museum of Valverde (Huelva)	Valverde del Camino
Cabárceno Natural Park	Cabárceno (Santander)

Eastern European Countries

The territories of the former Soviet block show less development in these areas than western Europe. The first museums are associated with the towns with mining schools, such as the Museum of Mining and Geology of Banska Stavnica (Schmnitz) in Slovakia, or the Mining Museum of Sopron (Odenburg) in Hungary.[37] In 1967, the Museum of Gold — Pepr Mine in Jilova, Czech Republic was organized.[38] Ko˘sica, a city in Slovakia declared as a World Heritage Site by UNESCO, has an East Slovak Artistic Casting Museum, with numerous objects, including a copy of Agricola's book "De Re Metallica" translated into Czech. Medzev Ironworks, 25 km from Ko˘sica, as well as the Museum of Iron of Lillafürd in Miskolc (Hungary) should also be mentioned.[17]

TABLE 11. Mining museums in eastern Europe

Museum	Location
Mine Pepr	Jilova (Czech Republic)
National Museum	Prague (Czech Republic)
Ostrava Museum	Ostrava (Czech Republic)
Iron Museum	Lillarfürd (Hungary)
Salt Mines	Wieliszka (Poland)
Sulfide Mines	Olskuz (Poland)
Mining Museum	Tarnowskie Göry (Poland)
Museum Gornictwa Weglowego	Zabrze (Poland)
Mining Museum	Petrosani (Roumania)
Museum of Gold of Transylvania	Brad (Roumania)
Mezev Ironworks	Medzev (Slovakia)
Museum Mine	Medenec (Slovakia)
Silver Mine	Bánska Stavnica (Slovakia)
Museum of Mining and Geology	Bánska Stavnica (Slovakia)
Mines of Mercury	Idria (Slovenia)

TABLE 12. Mining museums in Switzerland

Museum	Location
Bergbaumuseum und Besucherbergwerk Käpfnach	Horgen (Switzerland)
Bergbaumuseum Schmelzboden-Davas Schaubergwerk Silberbergwerk	Davon-Platz (Switzerland)
Eisenbergwerk Gonzen A.G.	Sargans (Switzerland)
Salzbergwerk Le Bouillet	Bex (Switzerland)

The most important mining museum in the eastern countries is Wieliszka, Poland (World Heritage Site), with more than 200 000 visitors per year. There, in an ancient subterranean halite mine, a museum of minerology and history of salt mining has been built. Ancient chambers situated among pillars as well as shafts and corridors can be toured. Chandelieres and statues made of salt, a church carved into the rock, subterranean boat rides and an underground restaurant are some of the museum's attractions. The most important mining museums and museum mines in east European countries are listed in Table 11.

Others

An industrial archaeology meeting was held in Greece in 1988, convened by the Archaeological Society of Athens; a small mining edifice in Lavrión has been recovered. Some mining museums are also found in Switzerland (Table 12).

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